US006892886B2

(12) **United States Patent**
Khoo et al.

(10) **Patent No.: US 6,892,886 B2**
(45) **Date of Patent: May 17, 2005**

(54) **CARRIER TAPE WITH REINFORCED RESTRAINING MEMBER**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 153 days.

(21) Appl. No.: **10/194,979**

(22) Filed: **Jul. 12, 2002**

(65) **Prior Publication Data**

US 2004/0007497 A1 Jan. 15, 2004

(51) **Int. Cl.**[7] **B65D 85/86**; B65D 73/02
(52) **U.S. Cl.** **206/714**
(58) **Field of Search** 206/713, 714, 206/715, 716, 717, 718, 820

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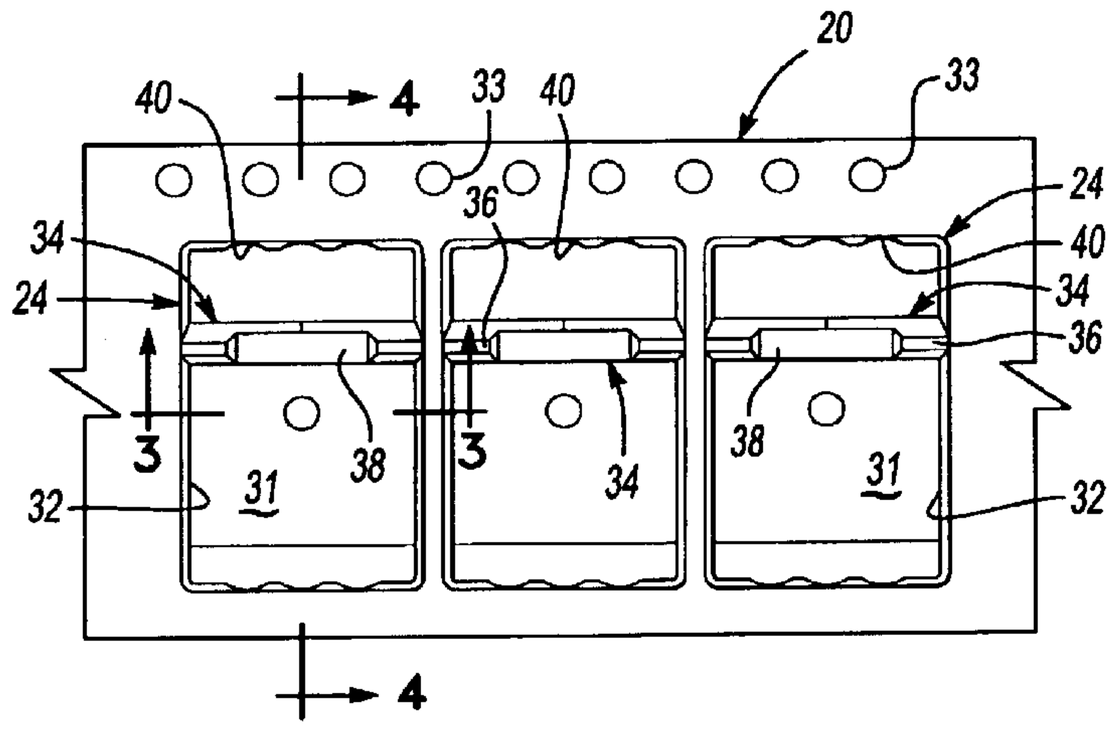
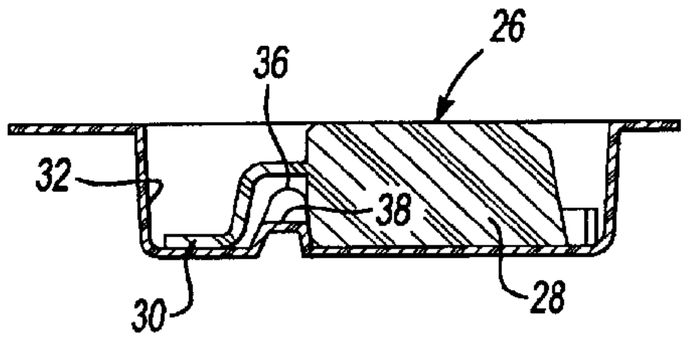
(57) **ABSTRACT**

A carrier tape for handling electrical components includes a reinforced component restraining member. Each pocket of the carrier tape includes at least one component restraining member that resists lateral movement of a component within the pocket. The component restraining member includes a first portion having a first height or spacing from a bottom surface in the pocket. A second portion of the restraining member has a second, taller height or spacing from the bottom surface. The first, lower portion reinforces the component restraining member and strengthens it to avoid lateral deformation during shipment or handling of the carrier tape when an electrical component is placed within the pocket.

14 Claims, 2 Drawing Sheets





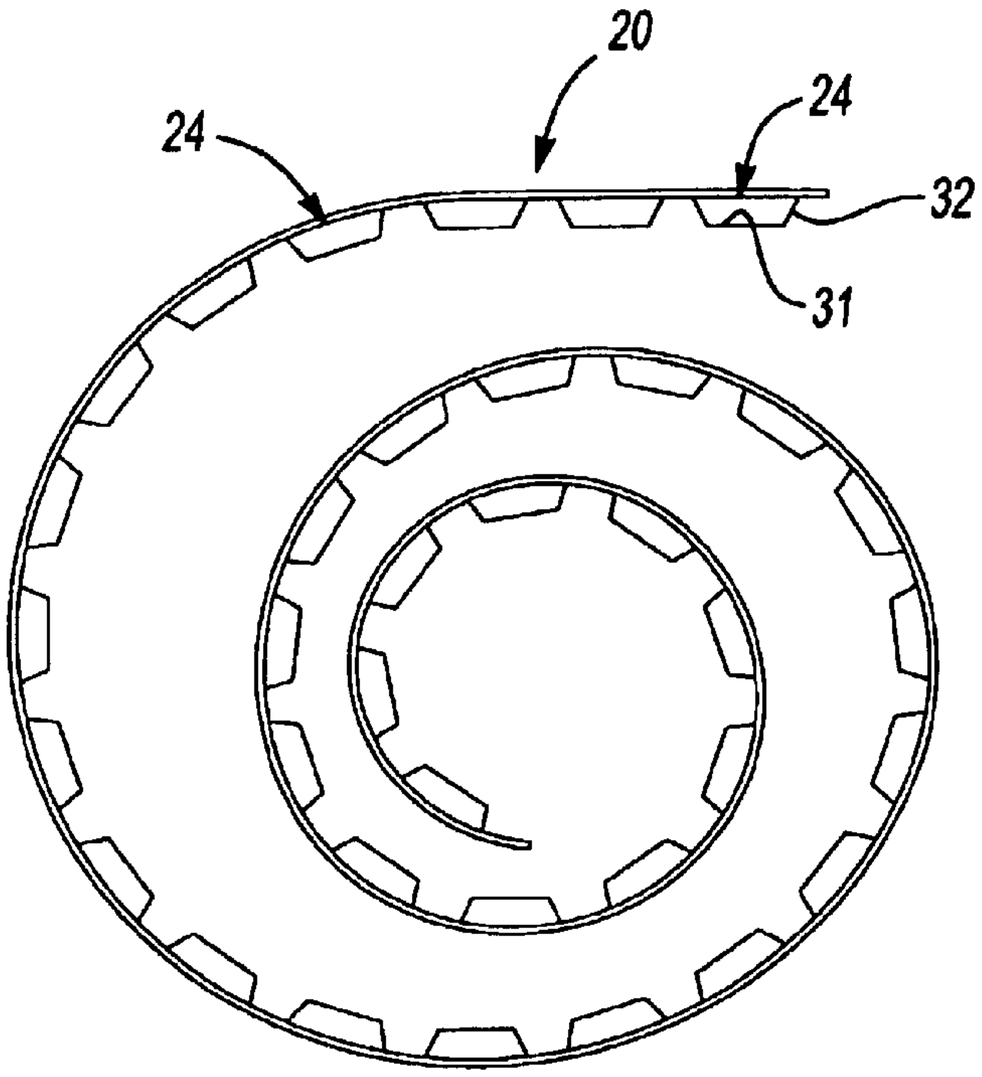


Fig-1

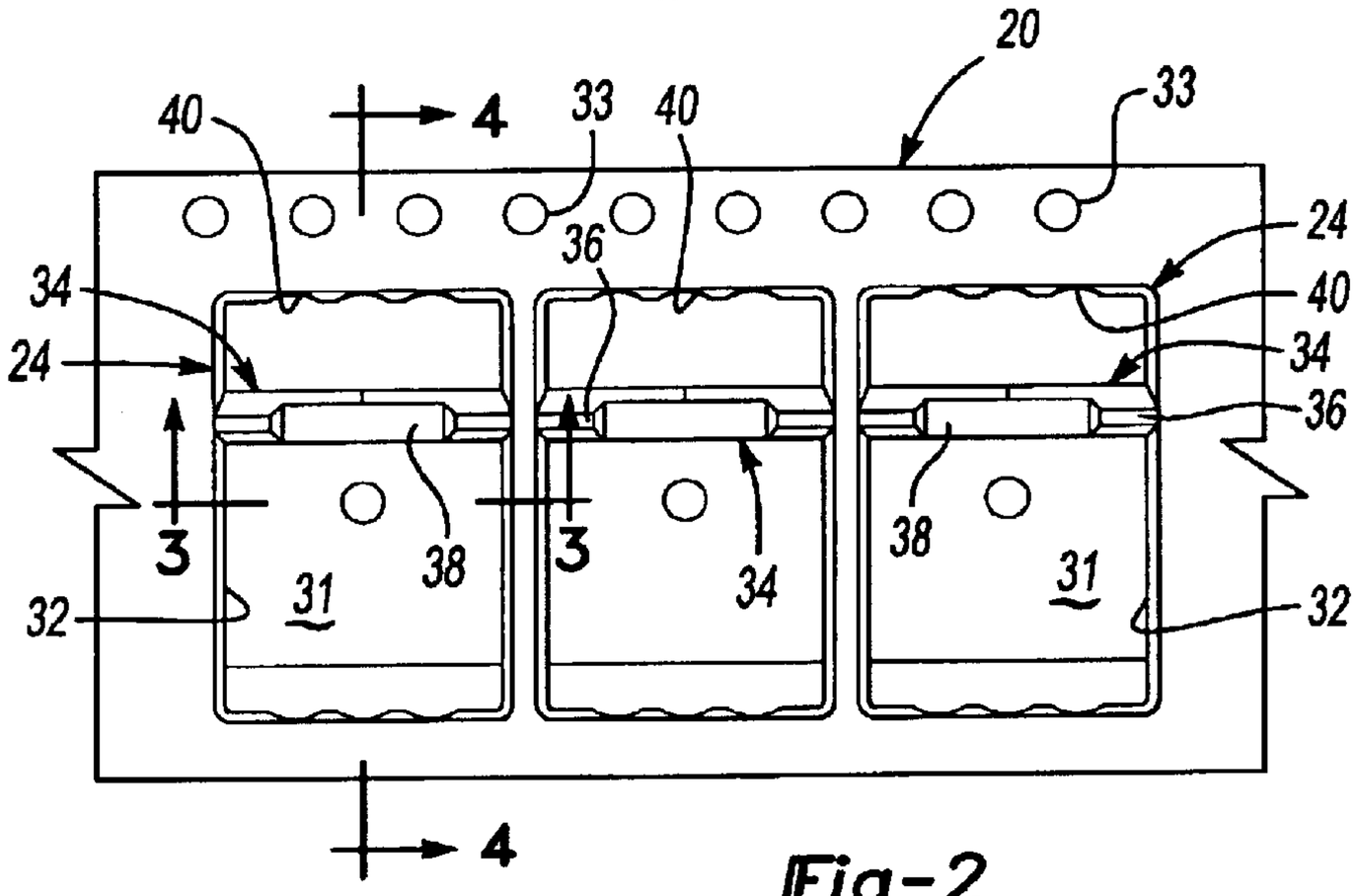


Fig-2

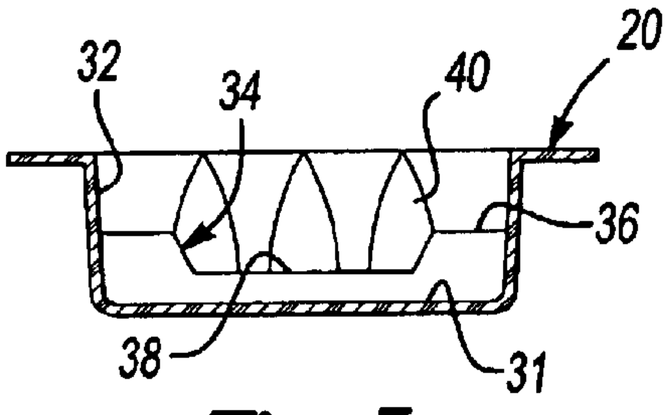


Fig-3

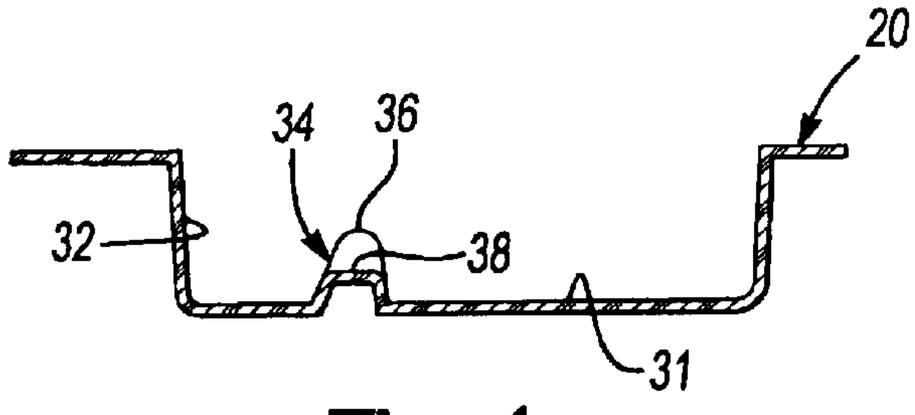


Fig-4

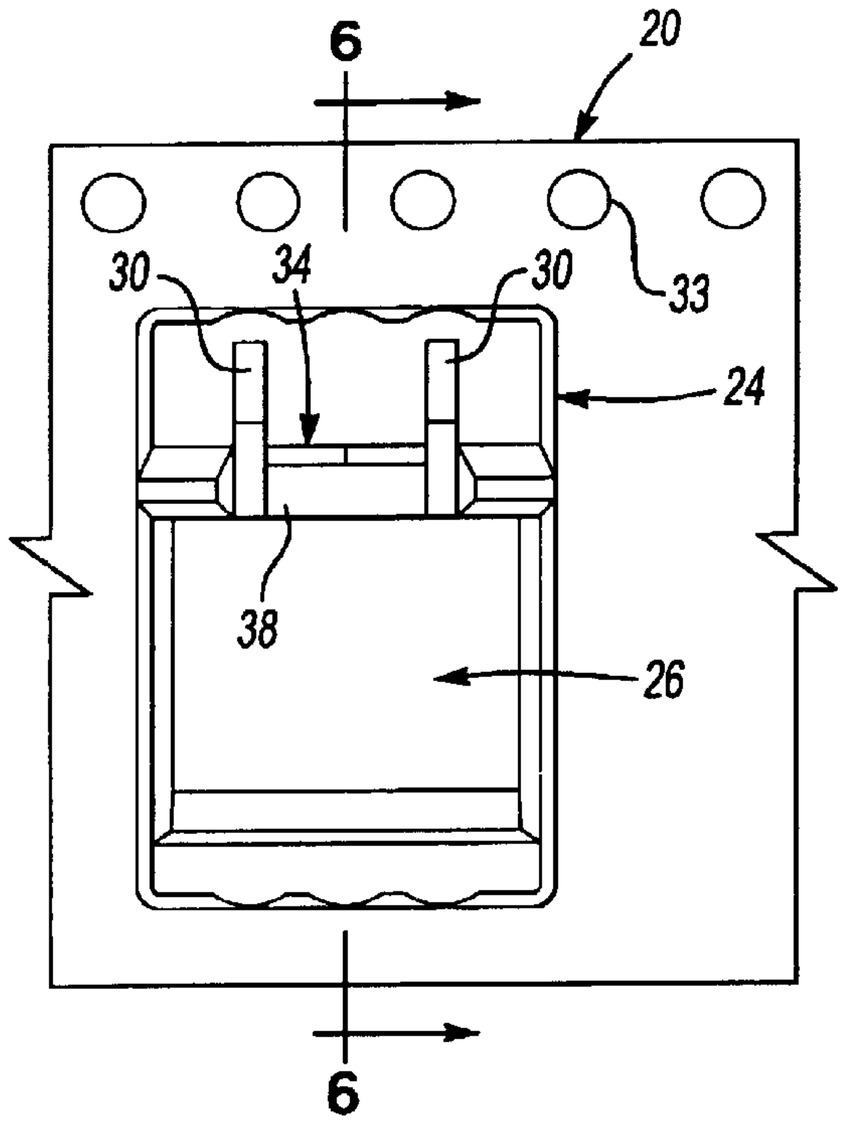


Fig-5

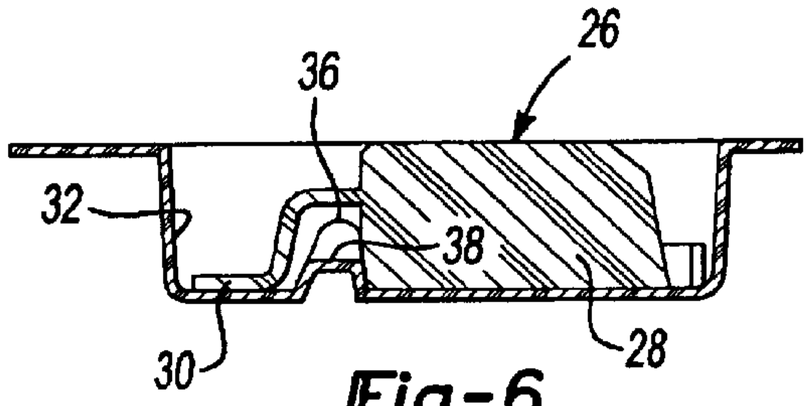


Fig-6

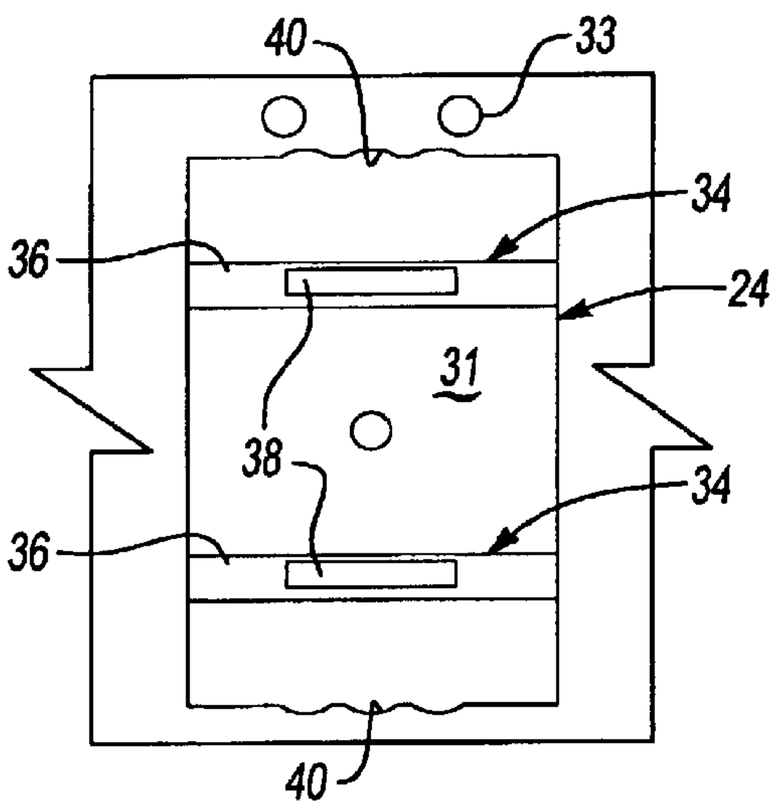


Fig-7

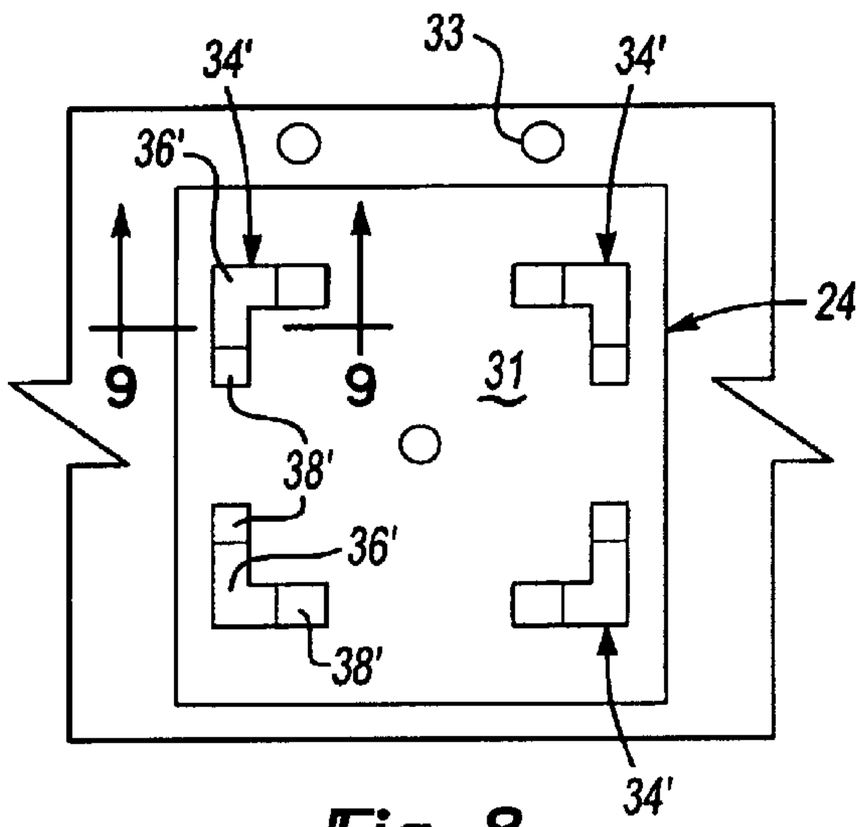


Fig-8

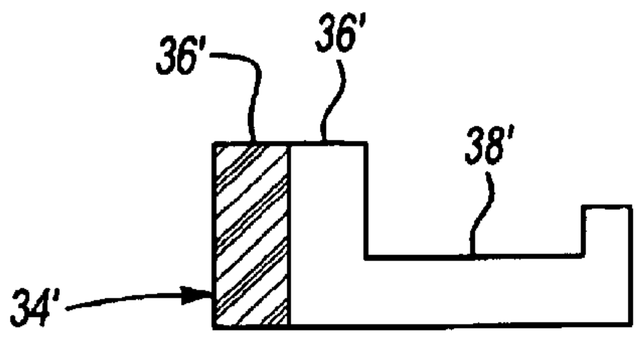


Fig-9

CARRIER TAPE WITH REINFORCED RESTRAINING MEMBER

BACKGROUND OF THE INVENTION

This invention generally relates to carrier tapes for handling electronic components. More particularly, this invention relates to a carrier tape arrangement having a reinforced restraining member for securely handling electronic components with external leads.

Carrier tapes for handling electronic components during shipment and storage are well known. A typical arrangement includes a plastic material tape with a plurality of vacuum-formed pockets into which the selected electronic components are placed for handling. A variety of carrier tapes have been designed to handle various types of electronic components.

One difficulty associated with carrier tapes is that electrical components having external leads may tend to move laterally within the pockets such that the leads pierce or penetrate the sides of the pockets. Such movement not only damages the pocket but potentially damages the leads. The further handling of the carrier tape presents the possibility for further damage or deformation to the leads.

One attempt at minimizing such problems is to include a raised surface within the pocket that is positioned to resist lateral movement of the electronic component within the pocket. The difficulty with such arrangements, however, has been that under some conditions, the raised surface collapses from the force of the laterally moving electronic component, resulting in the same problems otherwise experienced.

There is a need for an improved arrangement for a carrier tape assembly that adequately maintains electronic components with leads within the pockets and prevents undesirable lateral movement during handling. This invention addresses that need while avoiding the shortcomings and drawbacks of prior attempts.

SUMMARY OF THE INVENTION

In general terms, this invention is a carrier tape for safely handling electronic components having external leads.

One example carrier tape designed according to this invention includes a plurality of pockets formed along the tape. Each pocket has at least one sidewall extending away from a bottom surface. At least one component restraining member extends away from the bottom surface in the same general direction as the sidewall. The component restraining member has a first portion spaced a nominal distance from the bottom surface. At least one second portion of the component restraining member is spaced a second distance from the bottom surface that is greater than the nominal distance. Accordingly, the first portion reinforces the component restraining member to resist lateral deformation, thereby preventing unwanted lateral movement of the component within the pocket.

A method of making a carrier tape designed according to this invention includes forming a plurality of pockets on a carrier tape strip. Each pocket is formed with at least one component restraining member extending upward from a bottom surface within the pocket. Each component restraining member is formed with a taller portion and a shorter portion such that the height of the component restraining member varies relative to the bottom surface of the pocket.

The various features and advantages of this invention will become apparent to those skilled in the art from the following detailed description of the currently preferred embodiments. The drawings that accompany the detailed description can be briefly described as follows.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** schematically illustrates a carrier tape designed according to this invention.

FIG. **2** is a top elevational view of a selected portion of the embodiment of FIG. **1**.

FIG. **3** is a cross-sectional illustration taken along the lines **3—3** in FIG. **2**.

FIG. **4** is a cross sectional illustration taken along the lines **4—4** in FIG. **2**.

FIG. **5** shows a pocket of the embodiment of FIG. **2** with an electrical component in place.

FIG. **6** is a cross-sectional illustration taken along the lines **6—6** in FIG. **5**.

FIG. **7** illustrates an alternative arrangement having a plurality of component restraining members within a pocket.

FIG. **8** illustrates another example restraining member arrangement designed according to this invention.

FIG. **9** is a cross sectional illustration taken along the lines **9—9** in FIG. **8**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. **1** schematically illustrates a carrier tape **20** formed of a polystyrene material for handling a plurality of electrical components. The carrier tape **20** includes a plurality of pockets **24** each for containing an electrical component **26**.

Although the invention is not limited to any particular electrical components, the preferred embodiments of this invention are particularly well suited for electrical components **26** having a body portion **28** and at least one electrical lead **30** that is external to the body portion **28**. For purposes of discussion an electrical component **26** having two electrical leads **30** extending out of one side of the body portion **28** is used as one example component for which the embodiments of FIGS. **2–6** are well suited.

As can be appreciated from FIG. **2**, the carrier tape **20** includes a plurality of pockets **24** each having a bottom surface **31** and at least one side wall **32** extending away from the bottom surface. Depending on the configuration of the sidewall **32**, there may be four discrete sections or portions of the sidewall **32** as shown in the illustrated example. Depending on the type of component and the desired packaging density on the carrier tape, other sidewall configurations may be used.

Indexing holes **33** are provided on the carrier tape for conventional reasons.

Each pocket **24** includes a component restraining member **34**. The example arrangement of FIGS. **2–6** includes two taller portions **36** and one shorter portion **38** along the length of the component restraining member **34**. The shorter portion **38** preferably is spaced a first, nominal distance from the bottom surface **31** of the pocket **24**. The top surface of the portions **36** are spaced a second, greater distance from the bottom surface **31**. Accordingly, the component restraining member **34** has a varying height along the length of the restraining member.

In the illustrated example, the portions **36** have a generally arcuate or rounded top surface. The reinforcing portion **38** preferably is flat or generally planar across the top surface.

The entire component restraining member **34** preferably is vacuum formed at the same time as the pocket **24**.

FIGS. **5** and **6** illustrate an electrical component **26** supported within a pocket **24**. As can be appreciated from these drawings, the component retaining member **34** sits against at least one surface of the component body **28** and prevents lateral movement in a direction where the leads **30** would tend to contact or even penetrate the sidewall **32** of the pocket **24**. The flattened reinforcing portion **38** enhances the strength of the retaining member **34** so that such lateral movement is not possible.

The preferred arrangement includes corrugated modifications **40** to at least one of the portions of the sidewall **32** in an area that is most likely to be contacted by one of the electrical leads **30** in the event of lateral movement of the component **26**. Such corrugations reinforce the strength of the sidewall **32** in the corresponding region. The corrugations can be formed during the vacuum forming process used to form the pocket and the component restraining member **34**.

FIG. **7** illustrates an alternative arrangement having two component restraining members **34** within a single pocket. This particular arrangement is useful, for example, for electrical components that have leads **30** extending out of opposite sides of the body **28**.

Another arrangement is shown in FIGS. **8** and **9**, which is particularly well suited for accommodating components **26** having leads **30** extending out from all four sides of the body **28** (in the event that the body is rectangular, for example). In this example, the component restraining members **34'** are positioned at the corners of the placement for the body portion **28** of the component **26**. Each restraining member (i.e., at each of the four corners) includes a larger portion **36'** and a shorter, reinforcing portion **38'**. The larger portion **36'** in one example includes a generally arcuate or rounded top surface while the shorter, flattened portions **38'** include a general planar top surface.

A variety of other configurations of component restraining members having a varying height as disclosed are within the scope of this invention. Those skilled in the art who have the benefit of this description will realize what arrangement of the inventive reinforced restraining members will best meet the needs of their particular situation.

A method of making a carrier assembly designed according to this invention includes placing a carrier tape blank strip **20'** within a mold. At least one portion of the mold includes a surface contour that facilitates fanning the retaining member **34** giving the desired configuration. A conventional vacuum source creates the necessary vacuum within the mold to form the pockets and component retaining members. Conventional vacuum forming techniques appropriate for the material chosen to form the carrier tape can be used.

The preceding description is exemplary rather than limiting in nature. Variations and modifications to the disclosed examples may become apparent to those skilled in the art that do not necessarily depart from the essence of this invention. The scope of legal protection given to this invention can only be determined by studying the following claims.

We claim:

1. A carrier tape and electrical component assembly, comprising:

a carrier tape having a plurality of pockets formed along the tape, each pocket having a bottom surface and at least one sidewall extending away from the bottom surface and at least one component restraining member having a side extending away from the bottom surface and having a first portion spaced a nominal distance from the bottom surface and at least one second portion spaced a second, greater distance from the bottom surface such that the first portion reinforces the component restraining member; and

an electrical component received at least partially within the pocket such that one surface of the electrical component contacts the bottom surface of the pocket and another surface on the electrical component is received adjacent the side of the restraining member such that the restraining member controls movement of the electrical component relative to the bottom surface.

2. The assembly of claim **1**, wherein the first portion includes a generally planar surface.

3. The assembly of claim **1**, wherein the first portion has a surface that is generally parallel to the bottom surface.

4. The assembly of claim **1**, wherein the second portion includes a generally arcuate surface.

5. The assembly of claim **1**, wherein the second portion includes a generally polygonal surface.

6. The assembly of claim **1**, wherein at least one selected region of the sidewall includes corrugations.

7. Tho assembly of claim **1**, wherein each component restraining member includes perpendicular second portions with first portions at each end of each second portion.

8. The assembly of claim **1**, wherein the first portion is centered between two second portions that each extend between the first portion and corresponding locations on the sidewall.

9. A carrier tape and electrical component assembly, comprising:

a carrier tape having a plurality of pockets, each having a bottom surface and at least one component restraining member at least partially within the pocket having varying heights from the bottom surface along the length of the component restraining member; and

an electrical component at least partially received within the pocket such that one surface of the electrical component contacts the bottom surface and a second surface on the electrical component is received adjacent the component restraining member such that the component restraining member cooperates with the second surface to control movement of the electrical component relative to the bottom surface.

10. The assembly of claim **9**, wherein the component restraining member has a first portion that is lower than and centered between two higher second portions.

11. The assembly of claim **10**, wherein the first portion includes a generally flat surface.

12. The assembly of claim **11**, wherein the generally flat surface of the first portion is parallel with the bottom surface.

13. The assembly of claim **9**, including corrugations in a selected region of a sidewall of the pocket.

14. The assembly of claim **9**, wherein the component restraining member has a first section that is generally perpendicular to a second section and wherein each section has a first portion extending a first height away from the bottom surface and a second portion extending a second height away from the bottom surface.

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